Information and integrity in the information age

Converging technologies have changed the way we should look at information. Traditional paradigms of information suppliers and consumers no longer seem appropriate. Here Professor Simon Rogerson, of De Montfort University, Leicester, reviews the notion of information and its associated integrity using illustrations from the virtual world

Converging technologies have changed the way we should look at information. They raise a set of fresh issues which need to be fully explored and addressed if we are going to realise the full potential of the information age. The growing dependency on information and communication technologies to publish, consume and manipulate information has impacted upon economic and cultural life. The information age has spawned a new society – the information society.

The information society crosses traditional boundaries and as such comprises individuals from many different cultures. This cultural variability means that the expectations of individual cybercitizens can differ considerably. Nance and Strohmaier (1994) suggest there are two important dimensions to consider regarding this variability. The first dimension is the continuum from individualism to collectivism, whilst the second concerns cultural differences in communication referred to as low context communication and high context communication. Given this cultural variability it is clear that there are great difficulties in providing information in a form that is acceptable to all. This is certainly one of the great challenges of the information age.

The nature of information

But what is information? Eaton and Bawden (1991) suggest that information exhibits five intangible characteristics which differentiate it from other types of resource. The value of information is difficult to quantify. Information has a multiplicative quality in that it is not lost if it is consumed and indeed using information often causes it to increase in value and size. Information is a dynamic force in the system within which it resides. There is no predictable life cycle of information.

Finally information manifests itself in different forms relating to particular situations. Meyer (2005) extends this list to include other characteristics. Information has the attribute of alleviating uncertainty. Information is always an essential intrinsic component of technology. Information is a catalyst to enhance economic growth. Information extends the knowledge base. As Macgregor (2005) states: 'Ultimately information behaves in a unique manner when compared to other resources because it essentially represents the genesis of human thought, and is heterogeneous and intrinsically intangible.'

Technological maturity has reached a point where information of nearly every form is available at the touch of a button, the click of a mouse or the pointing of a cursor. Never before has it been possible to support many-to-many or many-to-one information publication and consumption. Existing new information conduits such as blogs, podcasts and wikis offer so much. Access is now possible to all forms of information including music, moving images, literary works and art. But what does the new form of access do to information? Does the technology detract or enhance a work of art painted by the artist to convey a specific piece of information. Whether value is being added or subtracted by such access is rarely considered.

It is this powerful characteristic which can change the nature of information and how we perceive it. Borgman (1999) suggests there are three types of information. There is information about reality in which reports disclose what is distant in space and remote in time. There is information for reality in which recipes transform reality and make it richer materially and morally. Finally there is information as reality in which recording information through the power of technology steps forward as a rival of reality. It is the latter which challenges the traditional view of information. Borgman (ibid) illustrates this third form with classical music: 'The technological information on a compact disc is so detailed and controlled that it addresses us virtually as reality. What comes from a recording of a Bach cantata on a CD is neither a report about the cantata nor a recipe-the score-for performing the cantata; it is in the common understanding of music itself.'

The information dichotomy

There is an interesting dichotomy in the technologically dependent information society. Information is the lifeblood of organizations in

the information age (Rogerson and Bynum 1995). Without it organizations cannot interact with individuals and other organizations along the supply chain. However, with the advent of computer technology and more significantly the convergence of this technology with other technologies such as media, the amount and type of information available has exploded. Tofler (1970) predicted this information overload where individuals and organizations were swamped with so much information that it prevented decision-making and actually reduced knowledge. This problem continues to grow at a seemingly accelerating rate. Indeed, Nielsen (2003) argues that we are reaching the point of saturation: 'Information pollution is information overload taken to the extreme. It is where it stops being a burden and becomes an impediment to your ability to get your work done.'

If humankind is going to survive this mutation of information lifeblood into information pollution a new way of thinking and an associated new way of operating has to be derived. As Evans (1979) remarks: 'Computers, in other words, have not arrived on the scene for aesthetic reasons, but because they are essential to the survival of a complex society, in a way that food, clothing, housing, education and health services are essential to a slightly simpler one. The truth is that one of the main problems – perhaps the main problem – of the time is that our world suffers from information overload, and we can no longer handle it unaided.'

Integrity and provenance

One aid that could reverse this mutation is explicit guidance as to the status of information as it is presented. In other words, to provide a rating of the integrity of the information before it is consumed. Information integrity is about accuracy, consistency and reliability of information content (Mandke and Nayar 2004) and information systems. If information is questionable then decisions and actions which are based upon it could be flawed and unsafe. The expectation that information has integrity and therefore is dependable and trustworthy is reasonable. But how can dependability and trustworthiness be demonstrated? Trustworthiness is an intrinsic reality. Its perception, particularly in the beginning, depends critically on the perception of certain extrinsic forms (signs, labels, messages, etc) that are understood to represent the presence of underlying trustworthiness (McRobb and Rogerson 2004). It is these extrinsic messages which would provide the much needed guide to information integrity.

If such messages were recorded over time then the information would exhibit a provenance. In general provenance defines the place of origin and is a proof of authenticity or of past ownership. Therefore, information provenance fixes the origin and network of ownership thus providing a measure of integrity, authenticity and trustworthiness. It provides an audit trail showing where information originated, where it has been and how it has been altered. In this way people would be able to consider how much credence they would give to a piece of information before acting upon it.

For any piece of information people should be able to answer: 'Can this information be believed to be true? Who created it? Can its creator be trusted? What does it depend on? Can the information it depends on be believed to be true?' (Huang and Fox 2004). According to Huang and Fox (ibid) information provenance has four levels; static, dynamic, uncertain and judgment-based. The static level focuses on provenance of static and certain information. The dynamic level considers how the validity of information may change over time. The uncertain level considers information whose validity is inherently uncertain. Finally, the judgment-based level focuses on social processes necessary to support provenance. This model enables information to be categorized which in turn provides integrity guidance.

Therefore, information provenance is a powerful instrument in improving information integrity. Consider this example. In the course of its enquiries a police authority collects information about an individual. This information is held within the police authority's information systems. Such information is allowed to be shared with a number of other authorized agencies across a secure network. Access is instigated by the agencies so no track is kept of where the information has been shared. Once this happens the copies of this information become legally owned by the recipient agencies. Agencies update this information for their own purposes and based upon their own intelligence. These new versions of the information are passed on to other authorized agencies. The police authority then updates the information about the individual based on new evidence. Agencies are not aware of this and continue to use their own version of the information.

In this situation there exist multiple copies of the information across a complex network of agencies. Copies are not the same and there is no mechanism in place to ensure that they are the same. Clearly the integrity of the information is questionable but those receiving it are likely to be unaware of this. Decisions may be made, based on this untrustworthy information, that have detrimental effects on the individual. If the information had been accompanied by the information provenance then decision makers would have been able to see how the information had changed and therefore consider how safe it was. Also provenance would have provided a method to track back to the provenance of original information held in the information systems of the police authority to check whether the original information had altered since it was first accessed. In the information society there is a moral obligation to address information integrity. Information provenance offers a normative instrument for turning this moral obligation into ethical practice.

Conclusion: the dangers of information meltdown

We all need information all of the time. It is information that enables us to exist and flourish as humans. The converging technologies are transforming information and its access at an accelerating speed. Our traditional information bearings have been demolished which in turn threatens to send us into information meltdown. The information age offers so much but only if we master the technological keys to the informational Pandora's box.

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